

CLAIMS

1. A vascular repair device, comprising:

a tubular graft body;

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a structural framework having at least two stents connected to said graft body; and

a curved longitudinal support member connected to said graft body and having a
centerline, said support member being substantially symmetrical with respect to said
10 centerline.

2. The vascular repair device according to claim 1, wherein said longitudinal support
member is of a material selected from the group consisting of nitinol, stainless steel,
biopolymers, Cobalt Chrome, and titanium alloys.

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3. The vascular repair device according to claim 1, wherein said longitudinal support
member has a flattened S-shape.

4. The vascular repair device according to claim 1, wherein said longitudinal support
20 member has a partial helix shape.

5. The vascular repair device according to claim 1, wherein said longitudinal support
member is curved with substantially asymptotic ends.

6. The vascular repair device according to claim 1, wherein said longitudinal support member is connected to said graft body independent of said structural framework.
7. The vascular repair device according to claim 1, wherein said longitudinal support member is connected to one of said stents of said structural framework.
8. The vascular repair device according to claim 7, wherein said longitudinal support member has an end connected to said one stent.
9. The vascular repair device according to claim 7, wherein said longitudinal support member has two ends each connected to respective ones of said stents of said structural framework.
10. The vascular repair device according to claim 1, wherein said longitudinal support member is pre-formed in said curved shape.
11. The vascular repair device according to claim 1, wherein said longitudinal support member has rounded ends.
12. The vascular repair device according to claim 1, wherein said longitudinal support member has a looped end with a curved longitudinal extremity.
13. The vascular repair device according to claim 1, wherein said longitudinal support member has two looped ends each with curved longitudinal extremities.

14. The vascular repair device according to claim 1, wherein said longitudinal support member is shorter than said structural framework.

5 15. A vascular repair device, comprising:

a tubular graft body;

a structural framework having at least two stents connected to said tubular graft body;

10 and

a curved longitudinal support member connected to said graft body independent of said structural framework.

15 16. A vascular repair device, comprising:

a tubular graft body;

a structural framework having at least two stents connected to said tubular graft body;

20 and

a longitudinal support member having two ends, at least one of said ends having a curved longitudinal extremity.

17. The vascular repair device according to claim 16, wherein said support member is curved.

18. A vascular repair device, comprising:

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a tubular graft body having a proximal end and a distal end;

a structural framework having at least two stents each respectively connected to said tubular graft body adjacent said proximal end and said distal end and defining a

10 separation distance therebetween; and

a longitudinal support member shorter than said separation distance and being connected to said graft body between said at least two stents to form a gimbal at at least one of said proximal and distal ends of said graft body.

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19. The vascular repair device according to claim 18, wherein said support member is curved.

20. A vascular repair device, comprising:

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a tubular graft body having a proximal end and a distal end;

a structural framework having at least two pairs of stents each respectively connected to said graft body adjacent said proximal end and said distal end, said stents of each of

said pairs of stents being separated from one another at said graft body to define a respective outer stent and a respective inner stent; and

a longitudinal support member connected to said graft body and extending between:

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at least said inner stent of a first of said two pairs of stents; and

at least said outer stent of a second of said two pairs of stents.

10 21. The vascular repair device according to claim 20, wherein said support member is connected to said graft body between both of said inner stents of said two pairs of stents.

22. The vascular repair device according to claim 20, wherein said support member
15 has ends each connected to said inner stent of each of said two pairs of stents.

23. The vascular repair device according to claim 20, wherein:

said support member has ends; and

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at least one of said ends is connected to said inner stent of one of said two pairs of stents.

24. The vascular repair device according to claim 20, wherein said support member is curved.

25. A vascular repair device, comprising:

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a tubular graft body having a proximal end and a distal end;

a structural framework having at least two pairs of stents each respectively connected to said graft body adjacent said proximal end and said distal end, said stents of each of
10 said pairs of stents being separated from one another at said graft body to define a respective outer stent and a respective inner stent; and

a curved longitudinal support member having two ends and being connected to said graft body between both of said inner stents of said two pairs of stents.

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26. The vascular repair device according to claim 25, wherein said support member is connected to said graft body without touching said inner stents.

27. The vascular repair device according to claim 25, wherein said support member is
20 connected to said graft body to touch at least one of said inner stents.

28. A vascular repair device, comprising:

a tubular graft body having first and second ends;

a structural framework having at least three stents, two of said stents being connected to said tubular graft body adjacent said first end, said two stents being separated from one another on said graft body to define an outer stent and an inner stent, a third of
5 said stents being connected to said tubular graft body adjacent said second end; and

a longitudinal support member having two ends and being connected to said graft body between said inner stent and said third stent without touching said inner stent and said third stent.

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29. The vascular repair device according to claim 28, wherein said support member is curved.

30. A vascular repair device, comprising:

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a tubular graft body;

a structural framework having at least two stents;

20 a first of said stents being connected to said tubular graft body along an entirety of said first stent;

a second of said stents having a periodically changing shape to define proximal apices having given radii of curvature and distal apices having radii of curvature smaller than said given radii of curvature; and

5 said second stent being connected to said tubular body at said distal apices.

31. The vascular repair device according to claim 30, wherein said second stent is connected to said tubular body only at said distal apices.

10 32. The vascular repair device according to claim 30, wherein said first stent has alternating proximal and distal apices with substantially equal radii of curvature.

33. The vascular repair device according to claim 32, wherein said radii of curvature is between approximately 0.1 mm and approximately 3.0 mm.

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34. The vascular repair device according to claim 32, wherein said radii of curvature is approximately 0.5 mm.

35. The vascular repair device according to claim 30, wherein:

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said graft body has a proximal end;

said second stent is connected at said proximal end; and

said proximal apices extend away from said proximal end.

36. The vascular repair device according to claim 35, wherein:

- 5 said first stent has alternating proximal and distal apices with substantially equal radii of curvature; and

said distal apices of said second stent have radii of curvature substantially equal to said radii of curvature of said proximal and distal apices of said first stent.

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37. The vascular repair device according to claim 36, wherein said proximal apices of said second stent have radii of curvature approximately equal to 1.5 mm and said distal apices of said second stent have radii of curvature approximately equal to 0.5 mm.

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38. The vascular repair device according to claim 30, wherein:

said first stent has a given amplitude; and

- 20 said second stent has an amplitude greater than said given amplitude.

39. A vascular repair device, comprising:

a tubular graft body;

a structural framework having at least two stents;

a first of said stents:

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having a periodically changing shape to define first proximal apices having first radii of curvature and first distal apices having radii of curvature substantially equal to said first radii of curvature; and

10 being connected to said tubular graft body along an entirety of said first stent;
and

a second of said stents:

15 having a periodically changing shape to define second proximal apices having second radii of curvature larger than said first radii of curvature and second distal apices having radii of curvature substantially equal to said first radii of curvature; and

20 being connected to said tubular body only at said second distal apices.

40. The vascular repair device according to claim 1, wherein said support member is substantially reverse-mirror symmetrical with respect to said centerline.

41. The vascular repair device according to claim 15, wherein said support member has a centerline and is substantially symmetrical with respect to said centerline.

42. The vascular repair device according to claim 17, wherein said support member
5 has a centerline and is substantially symmetrical with respect to said centerline.

43. The vascular repair device according to claim 19, wherein said support member has a centerline and is substantially symmetrical with respect to said centerline.

10 44. The vascular repair device according to claim 24, wherein said support member has a centerline and is substantially symmetrical with respect to said centerline.

45. The vascular repair device according to claim 25, wherein said support member has a centerline and is substantially symmetrical with respect to said centerline.

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46. The vascular repair device according to claim 29, wherein said support member has a centerline and is substantially symmetrical with respect to said centerline.

47. The vascular repair device according to claim 1, wherein said graft body has a
20 diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

48. The vascular repair device according to claim 1, wherein:

said at least two stents each have apices;

said structural framework has a distal-most stent; and

- 5 said distal-most stent has at least one more apex than another of said at least two stents.

49. The vascular repair device according to claim 15, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be
10 placed.

50. The vascular repair device according to claim 15, wherein:

said at least two stents each have apices;

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said structural framework has a distal-most stent; and

said distal-most stent has at least one more apex than another of said at least two stents.

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51. The vascular repair device according to claim 16, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

52. The vascular repair device according to claim 16, wherein:

said at least two stents each have apices;

5 said structural framework has a distal-most stent; and

said distal-most stent has at least one more apex than another of said at least two stents.

10 53. The vascular repair device according to claim 18, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

54. The vascular repair device according to claim 18, wherein:

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said at least two stents each have apices;

said structural framework has a distal-most stent; and

20 said distal-most stent has at least one more apex than another of said at least two stents.

55. The vascular repair device according to claim 20, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

5 56. The vascular repair device according to claim 20, wherein:

said stents each have apices;

one of said pairs of stents adjacent said distal end has a distal-most stent; and

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said distal-most stent has at least one more apex than another of said stents.

57. The vascular repair device according to claim 25, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

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58. The vascular repair device according to claim 25, wherein:

said stents each have apices;

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one of said pairs of stents adjacent said distal end has a distal-most stent; and

said distal-most stent has at least one more apex than another of said stents.

59. The vascular repair device according to claim 28, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

5 60. The vascular repair device according to claim 28, wherein:

said stents each have apices;

one of said stents is a distal-most stent; and

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said distal-most stent has at least one more apex than another of said stents.

61. The vascular repair device according to claim 30, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.

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62. The vascular repair device according to claim 30, wherein:

said first and second stents each have apices; and

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said first stent has at least one more apex than said second stent.

63. The vascular repair device according to claim 39, wherein said graft body has a diameter at least as large as a diameter of a vessel into which said graft body is to be placed.
- 5 64. The vascular repair device according to claim 39, wherein said first stent has at least one more apex than said second stent.
65. The vascular repair device according to claim 1, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
10 said stents have a substantially linear profile in said longitudinal direction.
66. The vascular repair device according to claim 65, wherein said stents have a linear longitudinal profile.
- 15 67. The vascular repair device according to claim 65, wherein said stents have a circular cross-sectional shape.
68. The vascular repair device according to claim 65, wherein said stents have a non-circular cross-sectional shape.
- 20 69. The vascular repair device according to claim 68, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

70. The vascular repair device according to claim 15, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

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71. The vascular repair device according to claim 70, wherein said stents have a
linear longitudinal profile.

72. The vascular repair device according to claim 70, wherein said stents have a
10 circular cross-sectional shape.

73. The vascular repair device according to claim 70, wherein said stents have a non-
circular cross-sectional shape.

15 74. The vascular repair device according to claim 73, wherein said non-circular
cross-sectional shape is selected from the group consisting of a ten-sided shape, a
twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided
shape, a twenty-sided shape.

20 75. The vascular repair device according to claim 16, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

76. The vascular repair device according to claim 75, wherein said stents have a linear longitudinal profile.

77. The vascular repair device according to claim 75, wherein said stents have a
5 circular cross-sectional shape.

78. The vascular repair device according to claim 75, wherein said stents have a non-circular cross-sectional shape.

10 79. The vascular repair device according to claim 78, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

15 80. The vascular repair device according to claim 18, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

81. The vascular repair device according to claim 80, wherein said stents have a
20 linear longitudinal profile.

82. The vascular repair device according to claim 80, wherein said stents have a circular cross-sectional shape.

83. The vascular repair device according to claim 80, wherein said stents have a non-circular cross-sectional shape.

84. The vascular repair device according to claim 83, wherein said non-circular
5 cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

85. The vascular repair device according to claim 20, wherein:
10 said graft body has a longitudinal extent defining a longitudinal direction; and said stents have a substantially linear profile in said longitudinal direction.

86. The vascular repair device according to claim 85, wherein said stents have a linear longitudinal profile.

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87. The vascular repair device according to claim 85, wherein said stents have a circular cross-sectional shape.

88. The vascular repair device according to claim 85, wherein said stents have a non-
20 circular cross-sectional shape.

89. The vascular repair device according to claim 88, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a

twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

90. The vascular repair device according to claim 25, wherein:

- 5 said graft body has a longitudinal extent defining a longitudinal direction; and
 said stents have a substantially linear profile in said longitudinal direction.

91. The vascular repair device according to claim 90, wherein said stents have a linear longitudinal profile.

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92. The vascular repair device according to claim 90, wherein said stents have a circular cross-sectional shape.

93. The vascular repair device according to claim 90, wherein said stents have a non-
15 circular cross-sectional shape.

94. The vascular repair device according to claim 93, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided
20 shape, a twenty-sided shape.

95. The vascular repair device according to claim 28, wherein:

said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

96. The vascular repair device according to claim 95, wherein said stents have a linear longitudinal profile.

5 97. The vascular repair device according to claim 95, wherein said stents have a circular cross-sectional shape.

98. The vascular repair device according to claim 95, wherein said stents have a non-circular cross-sectional shape.

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99. The vascular repair device according to claim 98, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

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100. The vascular repair device according to claim 30, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

20 101. The vascular repair device according to claim 100, wherein said stents have a linear longitudinal profile.

102. The vascular repair device according to claim 100, wherein said stents have a circular cross-sectional shape.

103. The vascular repair device according to claim 100, wherein said stents have a non-circular cross-sectional shape.

5 104. The vascular repair device according to claim 103, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.

10 105. The vascular repair device according to claim 39, wherein:
said graft body has a longitudinal extent defining a longitudinal direction; and
said stents have a substantially linear profile in said longitudinal direction.

106. The vascular repair device according to claim 105, wherein said stents have a
15 linear longitudinal profile.

107. The vascular repair device according to claim 105, wherein said stents have a circular cross-sectional shape.

20 108. The vascular repair device according to claim 105, wherein said stents have a non-circular cross-sectional shape.

109. The vascular repair device according to claim 108, wherein said non-circular cross-sectional shape is selected from the group consisting of a ten-sided shape, a

twelve-sided shape, a fourteen-sided shape, a sixteen-sided shape, an eighteen-sided shape, a twenty-sided shape.